

**We Claim,**

1. A modified polyethylene terephthalate copolymer comprising a terephthalic acid or its ester equivalent, an ethylene glycol, and a flexible long chain aliphatic dicarboxylic acid or its ester equivalent in which the molar ratio of ethylene glycol and PTA is 1 to 3.5 with 2 to 10 weight percent aliphatic dicarboxylic acid based on polymer PTA; a hydroxy terminated polyether polyol in which hydroxy terminated polyether polyol equivalent to 1 to 5 weight percent in the polymer; an aliphatic or alicyclic diol in which an aliphatic or alicyclic diol equivalent to 1 to 5 weight percent in the polymer.
2. A method for making a modified polyethylene terephthalate copolymer comprising:  
preparing slurry of MEG and PTA in molar ratio of 1 to 3.5 with 2 to 10 weight percent aliphatic dicarboxylic acid based on polymer and charging the same in the Esterification reactor;  
esterifying under nitrogen pressure of 1 to 2 kg/cm<sup>2</sup>g and temperature 250°C to 290°C, removing byproduct, water, and excess MEG by using separation tower, adding catalyst Sb<sub>2</sub>O<sub>3</sub>, 1 to 5 weight % hydroxyl terminated polyether polyol or acyclic diol or aliphatic diol, the thermal stabilizer, H<sub>3</sub>PO<sub>4</sub> and TiO<sub>2</sub> at the end of esterification;  
transferring the same to Polycondensation reactor under nitrogen pressure, carrying out polycondensation under vacuum and at temperature around 250 to 290°C and draining the polymer as strands.
3. A method for making a modified polyethylene terephthalate copolymer comprising:  
reacting aliphatic dicarboxylic acid of 2 to 10-weight percent and PTA with an excess of MEG at temperature between 250 to 290°C;  
injecting additives like antimony trioxide (200 – 400 ppm), titanium dioxide (0.2 – 0.3%) and 1 to 4-weight percent of hydroxy terminated polyether polyol or acyclic

diol or aliphatic diol, into oligomer line before entering into the vacuum flashing stage;

removing excess MEG, keeping the temperature of flasher between 265 to 290°C and the vacuum in the range of 100 to 150 mm Hg;

obtaining a low molecular weight poly(alkylene dicarboxylate) pre-polymer by maintaining the temperature in the Pre-polymerizer at 270 to 290°C and the vacuum in the range of 10 to 30 mm Hg;

removing any MEG remaining in the reaction mass and producing high molecular weight polyester at 270 to 290°C at a vacuum level of 0.1 to 3.0 mm Hg.

4. The method as claimed in claims 2 or 3, wherein the said method is continuous or batch polymerization.
5. The copolymer and its method of making as claimed in claims 1 to 3 wherein said aliphatic dicarboxylic acid is selected from adipic acid, sebacic acid, azelaic acid, etc.
6. The copolymer and its method of making as claimed in claims 1 to 3 wherein hydroxy terminated polyether polyol or aliphatic or alicyclic diol is selected from polyethylene glycol (PEG), Monoethylene glycol (MEG), polypropylene glycol (PPG) etc.
7. A copolymer filament comprising said copolymer as claimed in claim 1 which is melt spun into filament.
8. The filament as claimed in claim 7, wherein said filament is dyed with dispersed dye without dye carrier to have a dye index greater than 100.
9. The filament as claimed in claims 7 to 8, wherein said dye index of said dyed filament is at least about 120 - 600.
10. The filament as claimed in claims 7 to 9, wherein a controlled shrinkage of said filament is 6 to 10 %.
11. A yarn comprising said filaments as claimed in claims 7 to 10, wherein said yarn is POY or FDY.

12. The yarn as claimed in claim 11, wherein said yarn is optionally texturised to obtain DTY or FTTY.
13. The yarn as claimed in claims 11 to 12, wherein said yarn is dyed with a dispersed dye without dye carrier at 100°C to have a dye index greater than 100
14. The yarn as claimed in claims 11 and 13, wherein said dye index of said dyed yarn is at least about 120-600.
15. The yarn as claimed in claims 11 to 14, wherein said yarn has a controlled shrinkage of 6 to 10%.
16. A staple fiber comprising said copolymer as claimed in claim 1 is melt spun and further drawline processed into staple fiber.
17. The staple fiber as claimed in claim 16 wherein said staple fiber is dyed with a dispersed dye without dye carrier at 100°C to have a dye index greater than 100
18. The staple fiber as claimed in claims 16 and 17 wherein said dye index of said dyed yarn is at least about 120-600.
19. The staple fiber as claimed in claims 16 to 18, wherein said yarn has a controlled shrinkage of 6 to 10%.
20. A yarn comprising staple fibers as claimed in claims 16 to 19.
21. The yarn as claimed in claim 20, wherein said yarn is dyed with a dispersed dye without dye carrier at 100°C to have a dye index greater than 100.
22. The yarn as claimed in claims 20 and 21, wherein said dye index of said dyed yarn is at least about 120-600.
23. The yarn as claimed in claims 20 to 22, wherein said yarn has a controlled shrinkage of 6 to 10%.
24. The yarn as claimed in claims 11 to 15 and 20 to 23, wherein said yarn is used to produce woven or knitted fabric.
25. A woven or knitted fabric comprising yarn as claimed in claims 11 to 15 and 20 to 23.

26. The fabric as claimed in claim 25, wherein said fabric is dyed with disperse dye without carrier to have a dye index greater than 100 and 6 to 10% controlled shrinkage.
- 27 Modified polyethylene terephthalate copolymer and method for making the same and have low temperature dyeability, controlled shrinkage characteristics and improved tensile properties as substantially described herein with reference to foregoing examples 1 to 4.